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FLEXIBLE TEACHING AND LEARNING

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ABSTRACT

The development of ICT-based learning and teaching is characterized by the fact that learning and teaching are culturally and contextually situated activities and furthermore the fact that the relationship between technology and use of technology is a dialectic one, meaning that technology itself and the use of technology are interrelated and mutually interdependent. When it comes to developing flexible computer aided teaching, lecturers are instrumental in the development process and experience has shown us that in this development process it would be very useful for teachers to have tools and techniques to support their efforts. In order to ensure the highest quality *and* degree of flexibility in the development of flexible online education and learning, development must be based on systematic reflection and a critical attitude towards the educational and professional standards desired.

This article presents a model for planning and developing flexible computer aided teaching and learning. The model is developed on the basis of lessons learned in a pedagogic and organisational development project (Flexnet), and especially three qualities characterize it:

- It relates to the complexities of netbased teaching by taking into account the dilemma between offering the highest possible degree of flexibility and obtaining the best educational quality
- It operates on the assumption that teaching, learning processes and study materials are netbased/computer aided. These premises change the requirements of pedagogy, study materials as well as form of communication
- It has a learner-centred approach

In this paper, the Flexnet-project is presented as an example of design-based research, and the objective of the paper is to introduce an approach to pedagogical design which gives priority to teaching and learning as situated in local cultures and forms of practice.

1. INTRODUCTION

1.1 Flexible teaching and learning

Lifelong learning, work place learning, and continuing education – the demand for education and learning seems to have exploded in the late nineties and in the beginning of the new millennium. Both the UN and the EU emphasize the “learning society”, and the related issues of making learning more flexible and education more adaptable to the needs of individual learners. In a recent Danish survey prof. A. Lorentsen investigates the priorities of potential students in relation to the form and content of study programmes (Lorentsen 2004). Among other things, she finds that almost all respondents in the target group want a high degree of *flexibility* in order to accommodate their individual needs concerning time and place of work, supervision, teacher contact and choice of individual modules. For the past ten years or so, Europe has focused on e-learning in an attempt to meet the increasing demands for flexibility in adult learning and subsequently substantial funding has been put into research and development of distance learning programmes, educational technology, etc. This effort has to some extent suffered from too much emphasis on the technological aspects, and in 2001 OPEC reports the following:

“There is however no clear evidence that ICT investments made by the public sector have resulted in improved performance by teachers and/or learners, nor that it has improved the quality and access to educational resources on the scale predicted.” (OPEC 2001)

This leads to the following conclusion which illustrates that the matter is not as straightforward as expected:

“Technology alone does not deliver educational success. It only becomes valuable in education if learners and teachers can do something useful with it.” (OPEC 2001)

Today it is clear to both researchers and many practitioners that the complexity of both designing technology and taking it into use, and the complexities of teaching and learning dominate the field of technology enhanced learning. Thus it is important not to let our fascination of technology form our visions about learning. One possible way of avoiding an ICT-focused paradigm (Qvortrup 2002) is found by turning to the use of general models for educational planning, also when developing on line or technology enhanced learning and teaching (as I have also argued in Georgsen 2004). It is, however, not obvious how the integration of information and communication technology should be carried out in order to actually achieve more flexible study programmes and thereby meet the needs of the modern learner.

This paper presents a general model for educational planning and illustrates how the model has come to use in the design of on line-courses. The examples given in this paper are of flexible online teaching developed within a framework of critical, reflective use of technology. The model of educational planning builds on an understanding of ICT as a catalyst for change and a possible means of improving the quality of both teaching and learning online.

1.2 Structure of the paper

This paper is divided into four main sections. After the introduction in section 1, the setting for the empirical work is presented in section 2, where a research and development project is presented (the Flexnet-project) and objectives and work methods are introduced. In section 2.2, a model for didactic planning of ICT-based flexible learning and teaching is introduced. In section 2.3, the methodological and conceptual framework of the Flexnet-project is outlined. This is followed by an introduction of two examples of work carried out in the project (section 3). These two cases have inspired the model for didactic planning developed in the project. Section 4 concludes on the results and the model as steps towards the development of high quality flexible online learning.

1.3 Keywords in developing flexible online education

In order to systematically improve the flexibility in online education, a nuanced understanding of flexibility is needed. An increasing number of books and articles are being published on the issue of flexible learning, and many possible definitions are offered. Betty Collis and colleague Jef Moonen offer a comprehensive model of flexible learning in Collis & Moonen 2001 which introduces 19 flexibility dimensions related to issues of:

- time
- content
- entry requirements
- instructional approach and resources
- delivery and logistics

The authors furthermore point out that subscription to the concept of flexible learning implies offering the learner one or more choices on critical issues related to learning (cf. also Collis 1998).

It is clear, however, that there are limits to flexibility, since learning in institutionalized contexts is always met with economical, practical, subject-related and other forms of constraints. For instance, in most cases a minimum of students are required for a course to be taught; teachers and students have a limited time to spend on the course; the pedagogical approach chosen by the instructor; and the interactional modes related to this are specific examples of this. Thus we see that in order to get high quality teaching and learning, the *degree* of flexibility must be weighed against measures of quality as well as a number of other parameters. As mentioned earlier, the development of flexible online education is a highly complex activity with many possible areas of conflict, but also with great potential for improving existing practices. At least four main areas are important:

- pedagogy and learning theory
- technology use and development
- learning materials
- competence building and organisational development

As teaching and learning is closely bound to the cultural context in which it takes place, and also situated by all of these four concerns and the handling of them in the specific situation, planning and development of teaching, materials, etc. must be carried out by the teacher or at least in close collaboration with the teacher. To help teachers make decisions about their style of teaching, choice of materials, mode of interaction, etc., a model for educational planning is useful.

Lecturers at the Faculty of Vocational Teacher Education at the Norwegian Akershus University College, Hiim & Hippe, describe educational planning within the framework of *didactic relational thinking*, and their model describes six categories involved in the process of planning:

1. Student learning premises – knowledge, experiences, attitudes and skills that the students already possess when they come for the first lesson of the course;
2. External conditions – conditions that limit or make learning possible such as equipment, artefacts, time, place, classroom settings, teacher's resources, learning resources, etc.;
3. Objectives for the learning activity – what the students should learn from the course/activity in terms of knowledge, skills, attitudes, and competencies;
4. Contents – what the course is about, how content is selected, adjusted and presented;
5. Learning process – the process of change within the learning subjects (the students), and reflections on how the intended changes are facilitated;
6. Evaluation – assessment or evaluation in relation to the teaching process, in relation to the objectives for the course and in relation to the students' learning (Hiim & Hippe 1998, pp. 28-30)

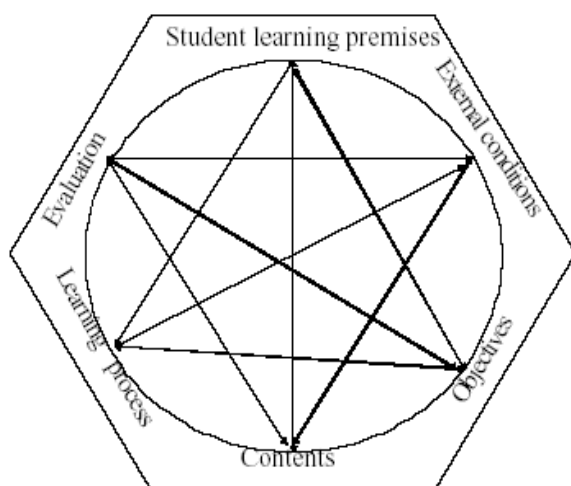


Figure 1: The diamond model illustrates the relevant factors in educational planning. The lines and arrows in the centre symbolizes how each factor influences the conditions of the others, and furthermore that no one element takes precedence over the others (Hiim & Hippe, 1998 p. 30)

An important feature of the diamond-model is the fact that each element in the model relates to the others. Reflective use of this model in combination with a design based research-approach offers great potential for pedagogical innovation. When it comes to the planning of teaching or other educational activities, consequences are that the pedagogic and professional considerations must be made explicit. It is not possible to plan a single aspect of the activity without also considering the others. The fact that the model presents all factors relevant to the planning process leads the teacher/planner into considering all of them and thus provokes pedagogic reflection in the teacher. This means that e.g. the use of ICT to support interactions must be argued for → why do students need to communicate with each other, in the light of the learning objectives what should they communicate about, etc. etc. Pedagogic reflection is necessary if we want more from the use of ICT in teaching and learning than merely a conversion of our current practices and methods into similar digital ones. In order to harvest the potential added value that ICT offers, teachers and planners need to reflect on the pedagogical choices they are facing. To do so, teachers and planners need to seek new knowledge to qualify them in the process of making informed choices about design, implementation, use and evaluation of the technology and online materials used in their courses. This is a demanding task in itself, and to add to this the relationship between the *learning process* (and the facilitation of it), the *learning objectives* and the *digital tools and materials* (the external conditions) becomes just as essential.

Based on the previous, keywords in developing flexible online education are *didactic reflection*, *dialectic understanding of technology and use*, and *situated teaching and learning*. These factors in combination point to design-based research as a natural choice of method for research and development, as one of the basic assumptions related to a design-based approach is stated as follows:

”Educational research that is detached from practice may not account for the influence of contexts, the emergent and complex nature of outcomes, and the incompleteness of knowledge about which factors are relevant for prediction”. (Design-based Research Collective, 2003 p. 5)

In the following, experiences derived from work within this conceptual and methodological framework are presented, and the complexity of the matter is illustrated through two examples from university courses that were offered as open flexible education for adult learners.

2. SETTING THE SCENE

This section presents the empirical background for the study reported on in this paper, namely a regional research project called Flexnet. The background and the objectives of the project is presented, as is the conceptual framework and the pedagogical approach developed.

2.1 The Flexnet-project

In the year 2000 the Danish government offered funding for research and development within a programme called the Danish Virtual University. This gave birth to the idea of trying to develop shared methods, tools, pedagogical and organizational ways of working, and thus the Flexnet-project (Flexible Netbased Learning and Teaching) came about. Lecturers in different academic areas, heads of studies, computer scientists, technology and learning experts all participated in the project, and as such an inter-disciplinary approach was taken. As financial support from the government failed, the project was eventually funded by IT University West, which is an educational network between four universities in the Western part of Denmark (IT University West). The aim of Flexnet was to develop high quality flexible e-learning, and throughout the entire project a specific overall approach was used to develop course modules, educational and communications technology, on line study materials, as well as teaching styles. The basic assumptions underlying this approach are described below as (in summary):

- the need for flexibility often conflicts with the ambition of high quality
- the core aspects of teaching and learning are interrelated and interdependent (as illustrated by the model of Hiim & Hippe)
- the realisation of the potential added value from the use of information technology is dependent on the right competencies of the teacher/planner
- teaching and learning are culturally situated activities and development thus needs to take place in situ – this calls for an experimental approach to the development process
- continuous evaluation and development/refinement of practice is an important means to achieving high quality

The objectives of the Flexnet-project was to develop flexible online courses of high quality, and the key concepts were defined as follows:

High quality achieved through three fundamental steps:

1. Pedagogic choices as the basis for any choice of technology
2. Focus on the possible consequences of maximum flexibility
3. Systematic evaluation and adjustment of course-activities

High flexibility achieved through:

1. Reduction of face-to-face encounters to a minimum
2. Development of course modules with low coupling and high cohesion
3. Support of interaction and learning with technology

As mentioned earlier, the issues of high quality and high flexibility easily come into conflict with each other. Thus, the reduction of face-to-face encounters may not always increase the quality of learning – depending on the group of students, the subject taught, etc. This also points to the fact that this approach calls for continuous discussion and critical evaluation of the specific pedagogical style, technological solution, way of working, etc. Efforts made towards pedagogical innovations is strengthened through local competencies for development. In design-based research local competence building is recognized as one of the outcomes of collaborating with teachers and other local actors. Three dimensions of flexible learning were focused on, namely choices in relation to *pedagogy*, *technology* and *study materials*. Through their work and contributions to the project, project members experienced and illustrated the interconnectedness of the three dimensions. Other obvious dimensions to be considered in the development process would be the *organizational dimension* or the aspect of *local competence building*, just to mention a few. However, due to the resources available in the project and a strong desire to develop new or improve existing flexible online courses or course-modules, the project focused its attention on the three dimensions mentioned above. The three dimensions are presented in more detail below.

→ **Pedagogy:** Through use of technology and use of changed study materials new possibilities are offered to the students. Pedagogy is all about facilitating learning. Thus, in order to take advantage of the potential added value of the technology, the planner/teacher must carefully consider the consequences of his or her pedagogic values. If e.g. the planner/teacher aims at constructivist learning, then study materials and communication technology used on the course must be selected and designed to facilitate and support this. As such, the Flexnet-model is “value-free” and allows for the implementation of various pedagogic perspectives. However, in the light of both the pedagogic values *and* the changed conditions for teaching, learning, working and communicating, careful consideration of the elements is needed.

→ Technology: Technology is always used within a specific context, and especially in relation to educational practice this situated perspective is important. Therefore, design, test and evaluation of technology/tools for educational purposes must be carried out in authentic settings in order to ensure that the tools and use thereof are adjusted to the settings and needs of the specific culture and subject matter.

→ Study materials: The characteristics of online materials are different from traditional paper based materials in more ways than one, and as such they, at the same time, hold new pedagogic potential and pose a challenge to teachers. Modes of interactivity is one important difference, an aspect that has been categorized on the basis of *production* and *control of distribution* of on line materials. Four main types of interactivity related to online materials can be identified:

- transmission – information and distribution are controlled by the sender (e.g. Internet radio transmission)
- conversation - information and distribution are shared between sender and recipient (e.g. chat)
- consultation - information is controlled by the sender, but the distribution of it is controlled by the user/recipient, as he/she decides when to access the information (e.g. web-sites)
- registration – information is controlled by the user (e.g. online formulaes or cookies) (based on Bordewijk & Kaam in Jensen 1999).

2.2 Methodological and conceptual framework of the Flexnet-project

As stated earlier in this paper, we need to think along the lines of combining the perspectives of pedagogy, technology and study materials, and acknowledge their interrelatedness in order to qualitatively improve the design of flexible learning activities, whether we concern ourselves with designing complete courses or just elements thereof. The three aspects automatically come into focus by taking the learning process as our point of departure for the design, cf. also the diamond model. The choice of communicational infrastructure or virtual learning environment becomes relevant when trying to cover the basics of interaction in order to increase the time and place-related flexibility. It is evident that many issues relate to communication, collaboration, distribution of materials, etc., as is well documented in research within the field of e.g. CSCL (CSCL 97, CSCL 99, O'Malley 1995, Koshmann 1994). These issues were also dealt with in the work reported on here. However, parts of the work also focused on a number of relatively "low-technology" applications and solutions that are easily developed but nevertheless seldom come to mind when online education is planned and the learning environment is designed.

A recent paper presents the idea of introducing a virtual learning environment into a number of existing study programmes as a "*didactic provocateur*" (Jensen 2004). The author argues that this new tool will serve as the impetus of change in teaching practices, and furthermore that changes will take place as a "*symbiotic enrichment-process*" (Jensen 2004, p. 5). The notion of enrichment is inspired by the work of Betty Collis, who in Collis 1997 and Collis 1998 introduces the idea of using ICT as either a means of *enrichment* or as a means of *reengineering*. The latter is a method developed with the purpose of fully integrating ICT into the pedagogical practice, and it is seen as a necessity when it comes to making teaching more flexible. At Collis' own institution pedagogical reengineering is supported by four critical moves (Collis 1998, p. 379):

- re-examination of our current institutional practice
- support from the administration
- funding to support the implementation activities
- the forming of a team of instructional designers

As such there are many similarities to be found between the concepts of didactic provocation or pedagogical reengineering and the approach taken in the Flexnet-project, especially in regards to the emphasis on the situatedness of teaching and the fundamental impact the use of technology is seen to have on all aspects of the teaching practice. The idea of technology as a pedagogically provocative agent, however, and the concept of enrichment does not seem to acknowledge the dialectic relationship between technology use and teaching practice. Jensen claims that the change caused by implementing a virtual learning environment (VLE) is minimal, based on the fact that in his case the introduction of the VLE was not based on the technical functionality of the system. Jensen also argues that from the introduction of the VLE considerable effect is seen in relation to pedagogic development, and thus he rejects the need for pedagogical reengineering. What the author seems to overlook is the fact that although the technical aspects of the VLE are not in focus, they cannot be ignored either (cf. also Dirckinck-Holmfeld 2002; Tolsby et al 2002). Any tool has inherent values and preferences which influences the ways it can be used for pedagogic purposes. It is important that the approach taken towards technology and implementation accommodates this. On this basis I argue that rather than achieving enrichment through the method described by Jensen, there is a danger of developing an ICT-focused paradigm, and thus missing out on the added value technology use has to offer the pedagogical practice.

To sum up, the understanding of educational activity as situated in cultural, historical and subject-related settings and traditions has implications for the manner in which educational development and pedagogical design takes place. As a consequence of this, a *situated* and *experimental* approach was chosen, leading to close collaborations between teachers, planners, students and developers participating in the Flexnet-project. Participants worked together in interdisciplinary groups across institutional borders. This in itself gave rise to many heated debates, but, more importantly, also to

the sharing of best practices and experiences. Experiments took place within the framework of the existing study programmes and courses. This provided authentic work conditions but at times it also gave rise to complications. Feedback on the experiments often came directly and before it was asked for. On some occasions it proved difficult to attain the necessary distance to the actual teaching practice in order to evaluate and reflect on the experiments, another wellknown challenge connected to a design-based research approach.

Another basic assumption of the project work was the dialectic nature of the relationship between technology and use of technology. This understanding, in combination with the experimental approach, marks a different approach than the one dominant within the field of *instructional design*. Usually in instructional design, the development of software is handled by a design team and carried out in isolation from the actual teaching practice. Although this tradition is currently in the process of changing towards more user involvement and influence in the design process (cf. Reigeluth 1983, Reigeluth 1999), fundamental differences still remain. In the work reported on here, the Danish tradition of bottom up-development in the universities prevailed. The fact that university lecturers in Denmark are accustomed to being responsible for pedagogic development and the fact that resources are available for pedagogic development secured a strong commitment of the teachers involved, and also contributed to the quality of the results.

3. EMPIRICAL EXAMPLES

This section presents two examples of local projects related to the Flexnet-project. The first case describes experiences with different uses of an annotation tool called the Highlighter, and the second one describes how a group of lecturers changed the teaching style in an introductory programming course through use of streaming video.

3.1 The Highlighter

The Highlighter is an annotation tool designed for adding comments to on line text, e.g. web-pages. The annotation tool shows itself in the menu of your browser, and allows you to add select text fragment in HTML-documents and add comments to them. The text fragment then becomes highlighted in the browser, and on mouse-over, the annotation is shown as a "tool tip". The Highlighter also allows you to add general comments associated to the entire document, so called page annotations. These are shown at the top of the Highlighter window. Once a user (e.g. a lecturer) has completed the annotations, the link collection is uploaded to a web-server and can be accessed by other users, e.g. the students. Navigating through the course material, the students now see the lecturers annotations as a transparent layer on top of the text. Students or other lecturers can add their own comments to the material, but are not allowed to change the original annotation collection not can they upload to Peter's web server without permission.

The most interesting aspect of the example is the way course developers and teachers have made use of the tool in the specific situations and activities. In one case, the lecturers have used it for adding notes to teaching materials already available on line. The purpose of this is to support the students' learning process and constructivist way of working, and at the same time let the students benefit from having access to the teacher's extensive knowledge in the field. In another incident the tool has been used by students to link personal notes to on line-materials and create collections of notes. This way of working allows for on line-collaboration between students based on their own contributions (e.g. comments on existing material), and thus makes it possible for students to work in ways otherwise not possible with for instance traditional books or paper based material. In concordance to the Flexnet-model we see that the use of this tool changes both *access* and *control* of the on line-material, and we also see that the students benefit from the added value of the technology in the sense that the tool helps them create materials collaboratively and dynamically in a way that supports flexibility. The changes in access and control over the study materials supports this ways of working. What could be seen (and evaluated) merely as the implementation of a technological tool, turns out to be also a pedagogic tool which actively supports student activity, collaborative ways of working, etc. (For a more elaborate presentation of the experiences with the Highlighter please see Jensen & Fibiger 2004).

3.2 Video Supported Instruction

The problem addressed in this particular project relates directly to the subject matter of the course, as it concerns the issue of illustrating operations performed by programmers. Programming is a new area for many adult learners attending further education within the IT-field, and is characterized by the fact that programming has both a theoretical and a practical side. In order to demonstrate their understanding of theory and method, students are required to demonstrate practical programming skills. In programming exercises, students often find it difficult to make head or tail of the solution they are required to produce, and since traditional text books in the programming field mainly focus on the *concepts* of programming languages (iteration, classes, etc.) instead of the *process* of creating a program, students are heavily challenged by this new world.

In Flexnet, a group of lecturers decided to use the technology of video streaming to enable them to visualize processes in programming. By using live videostreaming it became possible for the lecturer to illustrate how procedures were per-

formed, not only how the final result looked. A number of lectures were given where students followed the actions of the lecturer through the live streaming, and at the same time the instructor could comment on his actions. Students communicated with the lecturer – and amongst themselves – with the use of text-chat. After the on line-lectures videos were available to students at their personal convenience. Figure 3 below shows a screen-dump from an on line-lecture.

This use of video is an another example of how a technological solution not only enables flexibility in relation to time and place, but also supports the teaching style appropriate to the nature of the subject matter. In this case, programming-practice is demonstrated on the video and at the same time the instructor explains related issues of theory and method verbally. Experience from this case shows that video-examples based on partial solutions delivered by the students, enhance the motivation of the students because of their sense of ownership in relation to the solution. Thus a constructivist learning process is supported, a time-and-place flexible solution is offered, and the characteristics of both the subject matter and the student population are taken into consideration in the design (for a more elaborate presentation of this case please see Bennedsen & Caspersen 2003).

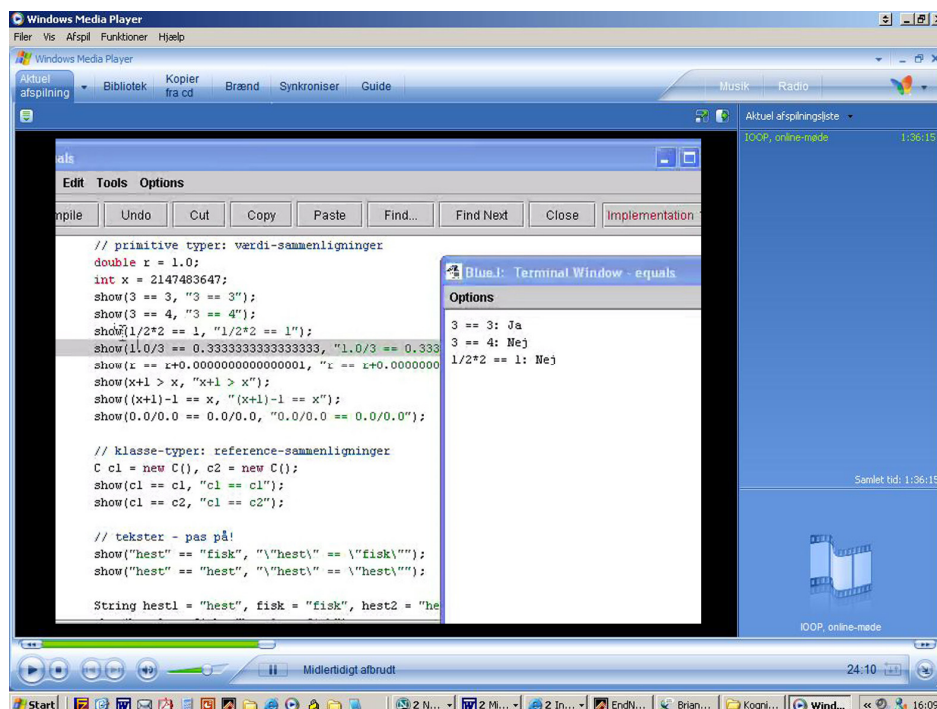


Figure 2: Screen capture of the streamed video instruction in use

4. CONCLUSIONS

4.1 Challenges in relation to flexible online learning

It is characteristic of CSCL-research in Denmark that it distinguishes between an *instructivist* and a *constructivist* paradigm of learning. As a consequence of the close bonds between the pedagogic traditions and the integration of ICT, it has been argued that e-learning is best implemented in connection with a radical restructuring of the didactic and pedagogic design of the learning environment (Lorentsen 2001). Lorentsen refers to Collis in her use of the term ICT as *enrichment* or *reengineering*. Lorentsen argues that only the latter has the potential to carry into effect the forms of learning and teaching that are relevant to the modern adult learner. The empirical examples in this paper point to various ways in which teaching and learning can assume a more flexible form and at the same time keep the pedagogic values and quality within sight. As demonstrated by the examples, the choice is not narrowed down to either a question of complete reengineering or what has been introduced in this paper as the rather reactionary ICT focused paradigm. Rather a third solution seems possible. This solution builds on respect for the local practice of teaching and learning, and keeps in mind the strain put on teachers and educational planners when presented with the demands of constant pedagogic and professional improvement.

The need to plan teaching and learning by use of deliberate didactic reflections seems to be a major challenge to modern teachers and educational planners, and the question of competence building becomes of great importance. In summary, the examples in this paper show that teachers need qualifications in a number of areas in order to develop highly flexible courses. It is clear that a teacher needs professional skill within their field of teaching, as well as within communica-

tion and interaction with students in order to facilitate learning. Both general and specific competencies within use of ICT are needed, and also collaboration with ICT-supporters, developers, etc. becomes an important part of a teachers work. Last, but not least, the characteristics of online materials is a new vital part of the online teacher's tool set. It is also clear, however, that the highly competent teacher in many cases uses technology in highly innovative fashions, and contributes to evaluation of existing technologies and design of future ones.

4.2 Lessons learned from the Flexnet-project:

Experiences from the project point to the fact that it is important to consider the role of the researcher in a project like this. In this case, local project managers were intended to take on the role as researchers as well as take care of management issues. It became clear that this was overly ambitious, and in concordance to the basic concepts of design-based research, we too learned that much is gained from working with the teachers/practitioners as co-researchers (The Design-Based Research Collective 2003). The bottom up-approach taken here has been extremely fruitful, but proves itself insufficient when it comes to making more substantial educational research, based on experiments in authentic settings. A number of ideas has been generated and tentatively tested during the time of the project. A relevant next step is to conduct investigations and studies that fall within the limits of predefined research questions and testing of hypothesis, etc. As such, methods and values of design-based research outline important steps in the direction of developing high quality flexible teaching in a collaboration between local experts and teachers and members of the research community.

4.3 Conclusions

In summary, the main conclusions on work presented in this paper are:

- In order to achieve high quality e-learning, digitalizing the classroom as we know it, is not the solution. It takes more than that.
- To create sustainable implementations of flexible online courses the complexity of the field must be dealt with.
- Due to the situated nature of teaching and learning exploratory methods in research and development are needed.
- Resources are needed for qualifying teaching staff and course developers into making informed and reflective didactic choices.
- Resources are needed for systematic evaluation of experiments and activities.

Rather than supporting an ICT-negative or an ICT-positive approach to the use of technology in teaching and learning I have assumed the position that a third approach is more fruitful. Based on the conviction that technology, didactics, competencies and study materials are interrelated dimensions in relation to online learning, the Flexnet-project points to what could be called an ICT-constructive approach. It is clear, however, that it presents numerous challenges for educational developers, teachers and decision makers in order to implement this approach in future pedagogic strategies for high-quality online teaching and learning.

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